Lyme Disease Vaccines

This application claims benefit of Provisional Applications Nos. 60/050,359 filed June 20, 1997 · Provisional Appl. 60/053,372 and 60/053,344 both filed July 22, 1997 and Provisional Appl. 60/057,483 filed Sep. 3, 1997.

1-3-05

Field of the Invention

The present invention relates to novel vaccines for the prevention or attenuation of Lyme disease. The invention further relates to isolated nucleic acid molecules encoding antigenic polypeptides of *Borrelia burgdorferi*. Antigenic polypeptides are also provided, as are vectors, host cells and recombinant methods for producing the same. The invention additionally relates to diagnostic methods for detecting *Borrelia* gene expression.

Background of the Invention

Lyme disease (Steere, A.C., *Proc. Natl. Acad. Sci. USA 91*:2378-2383 (1991)), or Lyme borreliosis, is presently the most common human disease in the United States transmitted by an arthropod vector (Center for Disease Control, *Morbid. Mortal. Weekly Rep. 46(23)*:531-535 (1997)). Further, infection of house-hold pets, such as dogs, is a considerable problem.

While initial symptoms often include a rash at the infection point, Lyme disease is a multisystemic disorder that may include arthritic, carditic, and neurological manifestations. While antibiotics are currently used to treat active cases of Lyme disease, *B. burgdorferi* persists even after prolonged antibiotic treatment. Further, *B. burgdorferi* can persist for years in a mammalian host in the presence of an active immune response (Straubinger, R. *et al., J. Clin. Microbiol. 35*:111-116 (1997); Steere, A., *N. Engl. J. Med. 321*:586-596 (1989)).

Lyme disease is caused by the related tick-borne spirochetes classified as *Borrelia burgdorferi* sensu lato (including *B. burgdorferi* sensu stricto, *B. afzelii*, *B. garinii*). Although substantial progress has been made in the biochemical, ultrastructural, and genetic characterization of the organism, the spirochetal factors responsible for infectivity, immune evasion and disease pathogenesis remain largely obscure.

A number of antigenic *B. burgdorferi* cell surface proteins have been identified. These include the outer membrane surface proteins (Osp) OspA, OspB, OspC and OspD. OspA and OspB are encoded by tightly linked tandem genes which are transcribed as a single transcriptional unit (Brusca, J. *et al., J. Bacteriol. 173*:8004-8008 (1991)). The most-studied *B. burgdorferi* membrane protein is OspA, a lipoprotein antigen expressed by borreliae in resting ticks and the most abundant protein expressed *in vitro* by most borrelial isolates (Barbour, A.G., *et al., Infection & Immunity 41*:795-804 (1983); Howe, T.R., *et al., Science 227*:645 (1985)).